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Hybridisation and invertebrate hosts – two neglected aspects of pest plants in south-eastern Australia

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Abstract

Many of the threats to our native flora, including habitat destruction, weed infestations, rabbits, are glaringly obvious. Hybridisation between native and 'introduced' species and introduced plant species acting as hosts for introduced pests are two threats that are generally overlooked by the casual observer. Examples are given of these two threats to our native plants. The implications of hybridisation and introduced plants acting as hosts on the long-term survival of our natural heritage are discussed. (*The Victorian Naturalist*, **124** (2), 2007, 117-122)

Introduction

The impact of introduced plants in Australia has gained national attention of late, being ranked as one of the highest risks to both economic and biodiversity values. The Co-operative Research Centre (CRC) for Australian Weed Management estimates that the cost of weeds to agriculture alone is in the vicinity of $4 billion per year (CRC for Australian Weed Management 2003). This figure does not take into consideration the impact of weeds on natural ecosystems, the potential loss of biodiversity values or the impacts on human health, most notable on hay fever sufferers (CRC for Australian Weed Management 2003).

It is estimated that there are 2 700 naturalised plant species in Australia, many of which were deliberate introductions for agricultural or ornamental use (Muyt 2001). Three hundred and seventy of these species are now of critical importance

Fig. 1. *Pittosporum bicolor* (Left), *Pittosporum undulatum* (Right) and hybrid (Middle).

(declared noxious in various states of Australia) and the focus of major control efforts (Thorp and Lynch 2000). In Victoria alone, there are over 580 taxa that are listed as major threats to either agriculture or the environment (DSE 2006). There is a range of national and state programmes to address the problem of weeds, the most notable being the Weeds of National Significance Programme and the Weeds and Pests on Public Land Initiative. This latter initiative is funded to the value of $14 million over a period of four years (DSE 2006).

Assessment of the impacts on biodiversity can be particularly hard to quantify, especially in an economic sense. However, the direct threats on particular plant, animal and vegetation communities can be noted. The Victorian *Flora and Fauna Guarantee Act* 1988 (FFG), has the provision for the listing of potentially threatening processes (PTPs). It is interesting to note that of the 36 presently-listed PTPs, five directly implicate weed invasions:

1. Invasion of native vegetation by Blackberry *Rubus fruticosus* spp. agg.
2. Invasion of native vegetation by 'environmental weeds'
3. Introduction and spread of *Spartina* to Victorian estuarine environments
4. Spread of *Pittosporum undulatum* in areas outside its natural distribution
5. Degradation of native riparian vegetation along Victorian rivers and streams.

In action statements prepared under the FFG Act 1988, 11 vegetation communities and 111 plant species are also considered directly threatened by weed invasions, with mention in each of these action statements of weed invasions (DSE 2006). Interestingly, it is not only plants that are threatened by weed invasions but a range of animals as well, most notably the Mountain Pygmy Possum *Burramys parvus* (DSE 2006).

While such direct threats as those listed above are commonly cited and are actively dealt with, there is a range of other less obvious and potentially more insidious impacts of pest plants that go unnoticed by many.

Hybridisation

Hybrid plants are the mainstay of our horticultural and agricultural industries but what happens when these plants occur in the 'wild'? Robin and Carr (1986) highlighted the issue of hybridisation between indigenous and introduced species and provided 19 examples from the genera *Acacia*, *Coprosma*, *Epilobium*, *Grevillea*, *Nicotiana* and *Pittosporum*. Twenty years later, hybridisation between indigenous and introduced plants still receives little attention but would appear to be an even greater risk than originally thought. A few examples may help to illustrate this point.

Banyalla *Pittosporum bicolor* is a small native tree that occurs in damp forest in the higher rainfall areas of Victoria, generally at higher elevations (Otways, Central Highlands, Central and East Gippsland) New South Wales and Tasmania. Conversely, Sweet Pittosporum *Pittosporum undulatum* is a large understorey tree of the lowlands originally confined to rainforest gullies of Victoria (South and East Gippsland), New South Wales and Queensland. The desirability of *P. undulatum*, for garden use, led to its introduction to gardens throughout Australia and indeed warmer parts of the world, soon after colonisation. The first record of hybridisation between these two species was not recognised as a hybrid when Morris and Curtis (1974) described the species *Pittosporum undulatum* var. *emmettii* from Tasmania. Since 1974, botanists have recognised the hybrid origin of this taxon and found it throughout the entire range of *P. bicolor* (Flora Information Service, DSE) (Fig. 1)

Silver Wattle *Acacia dealbata* is one of the most widespread wattles in Victoria, New South Wales and Tasmania, generally occurring in damp to wet forest and along rivers and drainage lines. Cootamundra Wattle *Acacia baileyana* is a small tree, naturally occurring in a small, low rainfall area around the Cootamundra to the Wagga-Wagga area of southern inland NSW. Like *P. undulatum*, *A. baileyana* is a very popular garden plant and widely naturalised in south-eastern Australia and several countries throughout the world. Hybrids between *A. baileyana* and *A. dealbata* were first noticed in the early 1980s (Flora Information Service, DSE). The hybrids between these two acacias have inherited characteristics from each parent

Table 1 List of hybrids between indigenous and introduced/ introduced native species in South-eastern Australia (Flora Information Service, DSE).

Acacia longifolia subsp. *longifolia* x *mucronata*
Acacia longifolia subsp. *longifolia* x *oxycedrus*
Coprosma hirtella x *robusta*
Coprosma quadrifida x *repens*
Correa reflexa x *glabra*
Epilobium billardierianum x *ciliatum*
Eucalyptus botryoides x *camaldulensis*
Eucalyptus globulus subsp.*globulus* x subsp. *pseudoglobulus*
Eucalyptus leucoxylon subsp. *bellarinensis* x subsp. *megalocarpa*
Eucalyptus leucoxylon subsp. *connata* x subsp. *megalocarpa*
Eucalyptus nitens x *ovata*
Grevillea rosmarinifolia x various species and hybrids
Hardenbergia comptoniana x *violacea*
Hardenbergia 'Happy Wanderer' *(comptoniana x violacea)* x *violacea*
Leptospermum laevigatum x *mysinoides*
Melaleuca armillaris x *ericifolia*
Nicotiana glauca x *suaveolens* (Nicotiana flindersiesis)
Nicotiana glauca x *velutina*
Pittosporum bicolor x *undulatum*

Table 2. Native forb genera on which RLEM have been observed to feed. * = very sensitive

Ajuga	*Kennedia*	*Rutidosis**
Arthropodium	*Leucochrysum*	*Stylidium**
*Brachyscome**	*Lotus**	*Swainsona*
*Craspedia**	*Microseris**	*Velleia*
Cullen	*Minuria*	*Wahlenbergia**
Glycine	*Podolepis*	*Xerochrysum*
Goodenia	*Pterostylis*	

that make them a cause for concern: from *A. dealbata* they have inherited the habit of extensive clonality (suckering), from *A. baileyana* drought tolerance (pers. obs.) These hybrids can be found growing in a wide range of habitats, from damp forests and rivers to dry hilltops, forming large vegetatively produced colonies tens of metres across (pers. obs.).

These are just two of the increasing number of species that are found to be hybridising in bushland areas throughout south-eastern Australia. What is the long-term impact of this type of 'genetic pollution' (Robin and Carr 1986) on our biological heritage? In all likelihood, several of our plants may be hybridised out of existence. In some cases, most notably *Grevillea rosmarinifolia* 'Hurstbridge Form', this already may have happened. Table 1 lists some examples of known hybrids.

Weeds as harbour for invertebrate pests

During studies carried out on the recruitment of grassland forbs in Victoria (Robinson 2005), it became evident that the introduced Red-legged Earth Mites *Halotydeus destructor* (RLEM) were feeding heavily on mature plants of many indigenous species. The feeding of the RLEM was causing considerable damage to the mature plants, in some cases weakening them to the point of death or in some cases preventing flowering. Investigations into RLEM revealed that they are a major problem in agricultural crops, reducing recruitment by up to 86% in Lucerne, Canola and various clovers (Liu and Ridsdill-Smith 2000).

Red-legged Earth Mites were introduced into Australia from South Africa in 1914 (Liu and Ridsdill-Smith 2000). Interestingly, in their home country, they feed primarily on members of the Daisy family (Asteraceae) and Pea family (Fabaceae) (Annells and Ridsdill-Smith 1994). One of their host plants in South Africa is the now ubiquitous Capeweed *Arctotheca calendula* (Annells and Ridsdill-Smith 1994). The mites cause very little damage to Capeweed apart from the odd stippling of leaves and slightly larger dead patches on leaves where they have extracted the contents of individual

Fig. 2. *Acacia baileyana* x *dealbata* on a dry hillside at Cottles Bridge, Victoria.

cells in the leaf (pers. obs.). The distribution of this pest is generally in south-eastern and south-western Australia at elevations below about 300 m. The distribution of this species coincides with the distribution of lowland grasslands and grassy woodlands in southern Australia (Lui and Ridsdill-Smith 2000).

A survey of plants susceptible to the privations of RLEM carried out by the author revealed that it was not only the agricultural crops and indigenous natives that were sensitive. Some of our most common and widespread weeds are sensitive to RLEM or act as host to the species. Most of the 'thistles' including Spear Thistle *Cirsium vulgare* and Variegated Thistle *Silybum marianum* host large numbers of this pest but still seem able to survive and reproduce (pers. obs.). Other species including several of the Chickweeds, particularly *Stellaria media* and *Cerastium glomeratum*, Shepherds Purse *Capsella bursa-pastoris*, and even the horticulturally desirable *Cyclamen* species are particularly sensitive hosts.

Light infestations of the above-listed introduced weed species, which occur in even the most intact grasslands and grassy woodlands, would provide harbour for RLEM. The spread of RLEM-sensitive weeds and their dominance of some vegetation types, coupled with infestations of RLEM, may be putting enormous pressure on our indigenous forb species. Observations by Neville Scarlett (pers. comm.) indicate that several of the Snout Mites, predatory mites that feed on RLEM, may be absent from 'disturbed' grasslands. Scarlett further observes that many of the indigenous species are sensitive to RLEM and the equally widespread Blue Oat Mite *Penthaleus major*.

The importance of weed control, coupled with invertebrate control, may be one of the keys to allow the successful recruitment and conservation of our indigenous forb species. Table 2 contains a short list of some of the genera sensitive to attack by RLEM.

Long-term implications

The hybridisation of indigenous and introduced species and the hosting of invertebrate pests by weeds could have long-term implications for the structure and floristics of plant populations. Alterations to the genetic make-up of populations, particularly the changes brought about by the mixing or homogenisation of formerly distinct

Fig. 3. *Acacia baileyana* (Left), *Acacia dealbata* (Right) and hybrid (Middle).

Fig. 4. Red-legged Earth Mites on the underside of a leaf of Shepherds Purse *Capsella bursa-pastoris*. Necrotic areas are damage caused by RLEM.

species, may bring about extinctions of some plants, even some of the most common species. The physical and ecological attributes of hybrid entities, particularly wider ecological amplitudes exhibited by the examples given above, extensive clonality and larger size may lead to replacement not only of the original species subject to hybridisation, but other species as well. In the case of *Pittosporum bicolor* x *undulatum*, the hybrid plant has most of the attributes of the introduced parent: larger size, denser canopy and more prolific flowering. This will lead to stronger competition with other plants, particularly for light and water. In the case of *Acacia baileyana* x *dealbata*, the strong suckering habit and much wider ecological tolerances of the hybrid will allow a wide range of vegetation communities to be invaded, with the consequent flow-on effects.

Genetic 'pollution' is difficult to assess and not readily evident to the casual observer. Complete replacement of the original genetic entity with the hybrid may not be evident until there is a recruitment event. This may be analogous to the case of the Red-tailed Black Cockatoo where there would appear to be many individual animals. It is not until there is an analysis of the age

structure of the population that it is realised that there are no young birds and most of the older birds are beyond reproductive age. In the case of *Grevillea rosmarinifolia*, there would appear to be many plants until one notices that all of the seedlings are of hybrid origin and the older plants are dying or unthrifty.

In the case of RLEM, predation of the seedlings of many of the grassland forbs may be creating a similar scenario to that described above. Many of the grassland forb species are long-lived perennials. Unfortunately, there is little evidence of recruitment of these species but the process of death and decay of the older plants continues apace. One or a few episodic events, a particularly bad drought or intense fire, could eliminate older plants, leaving little or no ability for recruitment within the population. Incremental and imperceptible loss becomes a sudden loss in these situations.

To overcome the above problems there is a need for intervention and further investigation of the problem. To date, there is little information to inform management decisions, particularly the setting of priorities and understanding the genetics or influence of hybridisation on the genetic makeup of populations. Additionally, there is a need for investigations into the recruitment dynamics of plants and the impact of weed invasions on recruitment, either directly or indirectly, and their impacts on vegetation dynamics in general. Controlling weeds is only a part of the solution to achieve what is in fact our primary goal: the attainment of high quality sustainable plant and animal communities.

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One Hundred and Twenty Years Ago

THE LOCUST PLAGUE.

A CORRESPONDENT at Murtoa, in the Wimmera district, forwards the following notes on this subject:–

"They appear to fly in swarms, in size varying from a few yards wide to over a mile, and of great length, as sometimes the flight continues from half an hour to an hour without the slightest break. They fly about 20 to 25 feet above the ground, and seem to be able to sustain themselves on the wing for a long distance, and I fancy those which rest, except for feeding purposes, are younger and weaker than the company they are in. They evidently camp at night. I went out about half-past eight for the purpose of catching some; they were all on the move as soon as they heard me, but only used their legs, and did not attempt to fly. They did not do much damage to the wheat crops in this district; but the grass paddocks were cleared right off in a day or two, so that the farmers will be obliged to sell their sheep at once for what they will fetch, as they have no feed left."

From *The Victorian Naturalist* **3** p. 131, February 1887